

When “Organizing Becomes an Extension of Your Brain”: DJs, Music Libraries and Information Practices

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Abstract

As contemporary discourses of technology move from identifying information overload as a general concern to designing applications and conducting investigations that understand information overload on a more granular level, it becomes increasingly important to conceptualize what information overload means in everyday life. This paper addresses issues of being overwhelmed by media, looking specifically at a group of people for whom the stakes of media organization are quite high, namely DJs. With the emergence of digitally-stored music, music enthusiasts have been able to build increasingly large collections, to the extent that users frequently become overwhelmed by tasks of organizing their collections and creating usable playlists. Drawing on semi-structured interviews with 13 DJs, I examine obstacles in organizing digital music. With thick descriptions of how music technologies are and are not meeting the needs of a high-use groups, this paper contributes to human information behavior research on organizational practices in everyday life within a particular community of practice.

Keywords: DJs, music, digital media, information practices, community of practice

Introduction

“There was like my parents’ definition of DJ, which was like Wolfman Jack, or whatever, and my definition of *real* DJ, which was Invisible Scratch Pickles and what not. And that has broadened both with technology, you know, now that there’s so many different ways to do it.” This description comes from Fin¹, a New York City based disc jockey (DJ), who is constructing a definition of DJ work, comparing his perception of what it means to entertain people with remixed and altered music with his parents’ definition of hosting a radio show. Interestingly, and central to the arguments I make in this paper, Fin argues that changes in technology have lead to changing definitions of what it means to be a DJ. But what, exactly, does Fin mean by this? What kinds of technology matter in defining DJ work? And what happens when those technologies change? This research project investigates the extent to which the definition of DJ work has (or has not) broadened as a result of technological change, focusing on experiences of information and media overload on the one hand and DIY (do it yourself) approaches to organizing and cataloging music on the other.

In order to expand understanding of existent practices of technology in everyday capacities, and to improve the design of systems related to music collection and production, I address a gap in research on actual information practices used to organize music in everyday life (Cunningham, Jones & Jones, 2004; Volda, Grinter, Ducheneaut, Edwards & Newman, 2005). In this study, I use ethnomethodological interviews with DJs to document organizational practices of media and analyze the impacts of technological change on a particular community of practice. Interviews with DJs enable inquiry into

¹ Pseudonyms are used throughout this paper to provide confidentiality for participants interviewed in this project. For more details on participants, see table 1.

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practices of music organization among a high-use group. This in turn allows for critical analysis of other kinds of information management related to heterogeneous collections of digital media that are increasingly becoming integrated into the daily lives of groups as diverse as music lovers, academics (eg Brown, 1999; Palmer & Cragin, 2008) and amateur cooks (eg Hartel, 2006).

Prior Work

Within human computing interaction (HCI) literature, personal music collections have been studied both to improve design and to understand technology in everyday life. Regarding the former category, research on music and technology have been used to improve search functionality, such as visualization tools to assist users in managing their collections (Torrens, Hertzog, & Arcos, 2004). Among user studies in this area, Cunningham et al. (2004) analyzed a rich set of ethnographic accounts of personal music collections, focusing largely on organization of CDs and MP3s. Cunningham and Nichols (2009) explored music listening practices in small groups using participant observation and interviews. Volda et al. (2005) used qualitative interviews with a group of office employees to analyze practices of iTunes music sharing, and explored connections between reputation, identity and shared music collections. Benford, Tolmie, Crabtree, Ahmed and Rodden (2012) studied collaboration between Irish folk musicians, revealing the extent to which practices of preparation were used even for work that was performed as impromptu. These studies contribute to a greater understanding of how technology and information are embedded in everyday music-related activities, such as parties (Cunningham & Nichols, 2009), live performances (Benford et al., 2012) and the office (Volda et al., 2005); In this project the emphasis is less on behaviors and norms within a given setting, and more on a specific kind of music collector – DJs. Because DJs rely on being able to tap their music collections in order to perform, they represent a high-use group, stakeholders with a lot to gain from deliberate, thoughtful practices of music organization.

In the specific context of research on DJs, Ahmed, Benford and Crabtree (2012) undertook an ethnographic study of DJ work to document an attachment to older media (such as vinyl) even as new forms were used. Gates, Subramanian and Gutwin (2006) analyzed DJs' tactics during performances, including moments of improvisation to respond to changes in a given crowd's reaction to music (see also Brewster & Broughton, 2000). Other ethnographic studies have focused on DJs' perceptions of technological change (Farrugia & Swiss, 2005; Montano, 2010), noting the tensions that emerge as DJs navigate shifting technological terrain while notions of "authentic" DJ work frequently privilege adherence to older technologies. Many of these studies look at DJ work broadly, considering music collection, organization, promotion and performance. In contrast, I focus explicitly on methods of organization and music gathering that have emerged among DJs as a community of practice, a term I define in more detail below.

Theoretical Context

DJ work is recognizable as DJ work because it adheres to certain norms of performance. As Fin (somewhat cynically) explained while I was observing him perform a DJ set, "the purpose of a DJ is to provide ambience. The purpose is for the crowd to see an actual human playing music." Undergirding that performance are much less visible but arguably more important practices of information and technological expertise. As Ron explained, "I haven't calculated, but probably less than one percent of the job is the actual playing. Far, far less, some measly percentage of one percent is actually playing music at shows. The rest is interviewing, talking about it, e-mailing people about gigs, producing." Although the display of a DJ's skill during performance may be highly individual (indeed, many DJs stake their reputations on the original interpretations of others' musical creations) the practices of collecting and organizing music mark a point of community between DJs in terms of shared practice, partly because they share similar obstacles in collecting digital media.

For Wenger (1998), participation in a community of practice encompasses both the "process of being active participants in the *practices* of social communities and constructing *identities* in relation to these communities" (p. 4, italics in original) where practice "includes both the explicit and the tacit. It includes what is said and what is left unsaid, what is represented and what is assumed" (p. 47). Irrespective of differences in the genre of music played, DJs constitute a community of practice through their shared experiences gathering, organizing and performing music. The labor undergirding DJ

practices is dispersed across multiple technologies, often conducted in multiple sites, sometimes alone, sometimes collaboratively. From a conceptual standpoint, this investigation of practices related to DJ work allows for critical analysis of the extent to which information practices are shared among DJs, and the relationship between technological change and DJ work.

Methods

This project takes a qualitative approach to information practices of DJs to craft a holistic understanding of how this community of practice undertakes work related to music media management. Between May of 2011 and March of 2012, I conducted 13 interviews with DJs in New York, Boston and San Francisco. Participants were located via snowball sampling, and because I was interested in comparing experiences between DJs who worked exclusively with vinyl as well as DJs who worked with digital music platforms, I screened participants to include both categories. Although I didn't specifically seek out participants who worked with Serato², all of the participants who used an MP3 platform to perform in fact used that application. Eleven interviews were conducted face to face, one via Gchat and one via Skype. Table one provides participant details, including method of interview, location, sex and whether DJs played vinyl or Serato. This binary is tricky to maintain; all DJs reported owning and listening to vinyl, and many DJs who predominantly use Serato occasionally play vinyl or CDs during shows, sometimes playing vinyl-only sets. Rather than signifying "vinyl only" or "Serato only," when I use the categories vinyl and Serato, it is to distinguish between DJs who exclusively play older forms of media when performing (vinyl and CDs, in the case of participants interviewed for this project) and those who use Serato, as well as other forms.

Table 1
Participant Details

Name	Vinyl or Serato	Sex	Location	Interview method
Barry	Serato	M	New York City	Face to face
Em	Serato	F	New York City	Face to face
Farrah	Serato	F	San Francisco	Face to face
Fin	Serato	M	New York City	Face to face
Jan	Serato	-	Boston	Face to face
Jarod	Serato	M	New York City	Face to face
Lola	Serato	F	Boston	Face to face
Randy	Serato	M	San Francisco	Gchat
Ron	Serato	M	New York City	Face to face
Bryant	Vinyl	M	New York City	Face to face
Carlos	Vinyl	M	New York City	Face to face
Gordon	Vinyl	M	Upstate New York	Skype
Jake	Vinyl	M	New York City	Face to face

Table 1 provides details on participants interviewed for this study. Pseudonyms are used to provide confidentiality. Jan preferred not to state a category for sex.

² Briefly, Serato is a software application that allows DJs to replicate the use of turn tables with digital music files rather than vinyl records. As Fin explains: "[There is a] Serato control record, and it doesn't just look like vinyl, it *is* vinyl. It has an audio signal ... so if you manipulate the record, the needle obviously transmits the same information ... Anything you do to that record, it would react exactly the same as if it were a vinyl record." Other applications, such as Final Scratch, provide similar functionality, but participants in this study preferred Serato, believing it to be a faster and more sophisticated tool.

Interviews were semi-structured and ranged from one to two and a half hours. During interviews, participants were asked to describe how they organize their physical versus their digital collections of music, how they keep on top of new music, and how they manage changes in technology related to music and DJing. Participants who used Serato were also asked to send screenshots of the application as a documentation of their organizing structure. Using an open coding method (Strauss & Corbin, 1990), interviews were analyzed using NVIVO software. In addition to interviews, I was able to accompany several DJs to shows and observe processes of searching for and selecting music during gigs. A short paper presenting initial analysis from this project (Lingel, 2012) was sent to a small number of participants, who provided feedback as a form of member checks (Cresswell, 2007); Member checks involve asking participants to review research findings and provide feedback and are used in qualitative research as a means of validating findings (p. 217). Drawing on all these sources (interviews, participant observation, analysis of Serato screenshots, member check responses), I describe practices of organizing music as a means of tracing themes of managing digital media collections and adapting to technological change.

Findings

Practices of Organization

In talking to DJs about their music, four main categories of work emerge: locating music to play at shows; organizing music; making or producing music; and performing. In this paper, I focus on the second category, organizing music, and even more narrowly on practices of organizing digital music. In future work, I hope to address practices of locating new music in terms of everyday life information seeking, and collaboration among DJs across these categories.

It's difficult to understate the sense of frustration that DJs feel when it comes to organizing digital music. As an illustrative example, Ron commented on frustrations of collecting global music:

It's especially bad with languages I don't understand ... Like, I remember this awesome song because it has a lot of o's in it. But I don't even know how to pronounce that. And it's awesome, but I don't know how to pronounce that shit. And a lot of the stuff is in Arabic. And since it came from the Internet and was stolen³, you know, I didn't get it from itunes and have it translated into English.

For DJs who specialize in playing cross-genre music, there's a particular push to collect diverse music, but as Ron points out, this brings an additional set of challenges. Participants were often quite aware that their current practices were lacking, as indicated by Jan: "my organization is awful, it's awful. I will name playlists based on mood sometimes, and that's not even consistent." Even as DJs acknowledge that their organization practices are lacking, they may have trouble altering these practices, feeling locked into the existing infrastructures that they've built. Obstacles to organizing digital music can be distilled into three basic categories: lack of tangibility, metadata and the size of collections, described further in table 2.

These obstacles make it difficult for DJs to organize their digital media consistently or coherently, which in turn can create problems when they're performing. Issues of unwieldy, unstable collections are not unique to DJs; in writing about adapting systems of classification from physical to digital collections, Shirky (2005) argued that a traditional, ontological approach to organizing assets works well for small collections with well-defined categories and stable entities. They also function well when maintained by expert catalogers leveraging authoritative knowledge of the collection and serving users with well-defined needs. These attributes characterize traditional, "brick and mortar" libraries with a classification scheme (such as the Library of Congress classification system) maintained by information professionals. In contrast, Shirky argues that traditional ontologies tend to fail for large collections with loose or organic categories and unstable, unrestricted entities. In particular, such a collection struggles to meet the needs of users who are uncoordinated, heterogeneous and lack deep knowledge in the specific focus of a given collection. What's interesting in the context of DJ work is that as users, DJs fall into the first category of highly- knowledgeable and authoritative sources of information about their music corpora. Their

³ Due to space concerns, I don't address the (il)legality of music acquisition in this paper, but it's worth noting that one means of evading detection of copyright violations is to alter information about an asset; outside of any moral or legal concerns about consequences of downloading music illegally, there are complications for metadata and cataloging in getting music from illegal or quasi-legal sources.

Tangibility	Metadata	Collection size
Gordon: I can't touch [MP3s] ... I remember the way things look, I remember where things were physically in proximity to other things ... One of the things that a database cannot do is be associative ... It can't be associative in the way that humans organize things. So I feel as though I might have one record that I can associate with a number of other, different associations, multiply associated with other things.	Ron: [Genre] is something that confounds my library skills on a daily basis, this is one of the most confusing things. I just go with my instinct ... It's an arbitrary decision. You have to have a bunch of tunes in order to justify a category, otherwise you can spread yourself really thin. Library-ness for library-ness' sake will ultimately confuse the guy that's thinking too fast and just looking for yummy bits of stuff.	Jan: It's really frustrating, just being overwhelmed. It's just too many, too much ... When I'm going out for a club gig, I'm usually not narrowing it down to these hundred records, like I will play these hundred records tonight, only these hundred records. I don't usually do that [with Serato], so there is an element of nostalgia, for when it was that simple.

Table 2 presents three main obstacles in organizing large collections of digital music, drawing on comments from interviews. Ron makes an explicit connection between DJ work and librarianship, a theme I address later on.

collections, however, fall into the latter of Shirky's categories, typically consisting of large, heterogeneous bodies of media that often lack formal categories. Thus DJ *collections* may be unwieldy, particularly for people who collect across a wide range of genres, but as *organizers*, DJs have both the professional motivation and subject-specific expertise to develop and maintain ontological systems of classification. This points to a key tension in DJ work as related to digital organization. To consider this tension more thoroughly, I discuss the practices of the two most organized DJs I interviewed, returning to Shirky's argument throughout to frame some of the issues surrounding information management for DJs' music collections.

In this section, I focus on two participants, Barry and Jarod, as indicative of the kinds of labor that DJs are willing to invest in organizing digital music, although I occasionally bring in remarks from other participants to illustrate or complicate a point. Both participants walked me through their systems by actually showing me iTunes and Serato on the laptops they use for DJing. They also each agreed to send screenshots afterwards. My point is not to generalize from these cases; in fact, these participants are exceptional in the deliberation and labor that goes into maintaining their collections. By looking at the workarounds and hacks that these DJs have created to facilitate their music, I'm interested in both identifying gaps between what DJs have and what they want, and also in looking at how the proliferation of digital media creates problems even for those with very sophisticated understandings of digital media.

Minimalism versus metadata

Barry is a fulltime DJ in New York who collects and plays a wide variety of genres, ("everything but trance") which he underscored during our interview by reading off some genres listed on his current Serato screen: cumbia, junk blues, Balkan, funk, Japanese hip hop, Brazilian, marching band. The heterogeneity of Barry's musical tastes have in part shaped the system of organization he's developed, and in which he takes a good deal of pride. During our interview, Barry seemed almost impatient for me to start asking about organization, at one point saying, "we've spent so much time talking about all this other stuff. The meat of the matter [is] I have what I think is a pretty unique system of the actual using of the music for performance ... It uniquely facilitates my unique way of music making." Barry's system hinges on two tenets – extreme minimalism in playlists and meticulous application of metadata.

Most DJs in this study utilize iTunes playlists and/or Serato crates to create collections of songs they intend to play in a given night, similar to the ways in which DJs who play only vinyl will assemble crates or record bags to prepare for a show. As Em explained,

[I] pull everything up [in Serato] and then build a little crate, and it's just like pulling records. So, Serato, you know gives you a little folder and instead of me taking vinyl 12 inches and putting them in a plastic milk crate, I'm pulling MP3s and putting them in a file folder. So I'm just replicating that process.

In fact, however, building crates in Serato is *not* an exact repliaton of stacking crates. For one thing, Serato crates are by track instead of album, such that each selection of a record yields approximately 10 songs, where selecting tracks is individual. As well, many DJs struggle to create playlists that are nebulously defined (for example, by genre, mood or type of gig) and with the inconsistent application of metadata. Both in talking to DJs and watching them perform, DJs frequently flip from list to list looking for a particular track, genre, beats per minute (BPM) or mood. Frustration often arises when inconsistent metadata means that a song won't turn up when expected. Other times a DJ will forget which list contains the track or type of track she needs. Barry's system seeks to counter these issues, starting with eliminating the creating of multiple playlists into one list that contains everything he intends to play: "You know how people have all these huge lists of different genres? I have *one* ... Everything goes into a big same bin and that terrifies a lot of people."

#	song	bpm	length	artist	album	genre	grouping	bitrate
997	Free Style (What We Wanna Do Edit) Remaster 24	123	06:35.52	Sylvers vs. Disco	Barney Iller and Phyllis	Disco Funk	Party Time 1	253.0kbp
998	Sleepy Hollow	123	07:26.90	Stefan Goldmann	Sleepy Hollow Vinyl	House	House 3	236.0kbp
1000	supersonic revelation (marathon men rmx)	123	05:50.27	simbad	supersonic revelation e	House	House 3	203.0kbp
1001	How Do You Let a Good Man Down?	123	03:02.01	Sharon Jones and the Dap-Kings	Naturally	Funk	Funk 3	258.1kbp
1002	message from yo' mama	123	04:48.31	SMOOTH	message from yo' mama	Acid Jazz House	Acid Jazz	193.0kbp
1003	Back In My Heart (In Ya Ear Mix) full & gospelly, a	123	06:54.48	Roger S.	Secret Weapons Vol. 2	House Classic	House Add 5	131.0kbp
1004	Back In My Heart (Factory Mix) minimal throug	123	05:48.66	Roger S.	Secret Weapons Vol. 2	House Classic	House Add 5	169.0kbp
1005	Foxy Girls In Oakland	123	02:48.54	Rodger Collins	Bay Area Funk / Funk I	Funk Soul	Funk 3	192.0kbp
1006	New World Prod. By Simbad	123	07:30.61	Robert Owens	Night-Time Stories	House	House 3	320.0kbp
1007	Movin' On (Original Mix)	123	07:10.89	Rachael Mott	For the Love of House V	House Classic	House Add 8	320.0kbp
1008	rebirth melody - casanova 123/100	123	11:19.08	rebirth brass band	hot venom	Funk Soul Brass Marching Band Bridge	Funk 3	198.0kbp
1009	Indestructible (Diesel Mix)	123	03:58.68	Ray Barretto	Rabutz presents 06	Latin Breaks	Latin 1	203.0kbp
1010	Chelsea (Yam Who Rework)	123	07:35.78	Prince	Chelsea (Yam Who Re-A	Disco Funk	Disco 2	211.0kbp
1012	Libella Swing	123	04:44.94	Parov Stelar	Libella Swing	Swing House Breaks	House Add 5	320.0kbp
1013	41 Street Breakdown	123	03:21.98	Nasom Davis & The Knights	The Disco Funk 45' Col	Funk Soul	Funk 3	193.0kbp
1014	Piratez Do Caribe	123	04:13.80	Memo and D.J. Ricardinho	Malenta	Brazilian Favela Breaks Pirate	Add New 7c	246.7kbp
1015	dancelfloor_whoa_(new_malenta_track)-nuc	123	03:32.42	Malenta	Malenta	Breaks	Party 10	231.0kbp
1016	Chicago, Detroit, Redruth	123	05:33.11	Luke Vibert	Chicago, Detroit, Redru	Acid House	House 3	195.0kbp
1017	Smoke	123	04:04.71	Latin Soul Rock All Stars	Playtime	Latin Disco Cop Theme	Latin 1	215.0kbp
1018	Any Trouble (intro around 115)	123	06:16.11	Kofi Sammy	99 Songs (Amazon MP3	African Highlife Tribal	Funk Add 5	162.0kbp
1019	black barbie (stereotv remix)	123	04:26.84	Jahcoozi	Black Barbie EP (KY051	Breaks	Party 10	204.0kbp
1020	Deep Inside	123	05:22.23	Hardrive	House Masters	House Classic	House Add 5	150.0kbp
2375	Equibreal	123	08:42.58	Dubtribe Sound System	Dubtribe Sound System	House Tribal	House Add 8c	320.0kbp
2365	Brooklyn	123	05:55.19	Doyo	Doyo	Brazilian Favela Breaks	Add New 7f	192.0kbp
1022	Ten Percent	123	08:59.40	Double Exposure	Classic Salsoul Masters	Disco	Disco 2	192.0kbp
1023	Soulonic (Malenta's No Funk Remix)	123	06:17.18	DJ Friction	Whow! Disc 2	Breaks	Party 10	192.0kbp
1024	Sueltata Pa' Que Se Defienda	123	02:35.51	Corraleros De Majagual	V.A. - Arriba La Cumbia	Latin Cumbia	Party Time 2	320.0kbp
1025	Deep Throat (Sebastian Leger Mix)	123	06:36.08	Claude Vonstroke	Deep Throat Vinyl	House	House 3	217.0kbp
1027	Jonsa Poca (MT cover)	123	03:20.28	Cheese People	Jamail weat remix	Psych Rock Cover Russian	Add New 7d	320.0kbp
1028	All I Can Do - 123ish	123	03:28.35	Carpenters	All I Can Do Vinyl	60's Mod Pop Folk	Party Time 1	188.5kbp
1029	Lamp Post Funk	123	02:47.81	Boxcutter	Arecibo Message	Disco Boogie Breaks House	Party Time 1	229.0kbp
1030	Hit the Bit feat. Yo Majesty (Lorenz Rhode Remix)	123	06:24.68	ben mono	hit the bit remixes	Breaks Electro House	Party Time 1	199.0kbp
1031	Kebab Connection	123	03:59.33	[dunkblut] & Cloud Tissa	Balkan Grooves	Balkan Dancehall Breaks	Add New	214.0kbp
1038	Papa was a rolling stone	122	04:50.14	The Pioneers	Funky Kingston reggae	Reggae Soul Cover	Jamaican 1	192.0kbp
1041	Down to Love Town (intro 120)	122	05:55.16	The Originals	Super Rare Disco Vol 2	Disco	Party Time 1	219.0kbp
1031	No No	122	05:06.73	Swell Session vs Mr Scruff feat Els	Swell Communications	Acid Jazz Swing House	Acid Jazz	179.0kbp
1032	Mambo Source (Gerardo Frisina Latin House Remix)	122	07:15.24	Stardish	Acid Jazz Tribal Japanese Latin House	Party Time 2	249.0kbp	
1033	Sunshine of Your Love	122	03:43.97	Spanky Wilson	Tom Middleton Presents	Funk Soul Cover B-Boy	Funk 3	193.0kbp
1034	Bobine	122	04:56.96	Ska Cubano	Ay Caramba!	Latin Tribal	Latin 1	192.0kbp
1035	5678	122	06:04.96	Shut Up & Dance	Old School Breakz	Hardcore Breaks Hip-Hop House	Party Time 6	320.0kbp
1037	Remind Me	122	03:39.61	Rikyrock	Melody A.M.	House	House 3	194.0kbp
1036	outtar-net	122	04:04.24	Ryo the Skywalker	ONE-DER LAND	Dancehall Reggae Japanese	Add New 7b	255.0kbp
1039	Black Land	122	05:25.28	Panoptikum feat Blue Eyez	Black Land of The Nile	House	House 4	208.0kbp
1040	Black Land of The Nile parts 1 & 2 104/122	122	08:25.81	Panoptikum feat Blue Eyez	Black Land of The Nile	House Acid Jazz Bridge	House 4	208.0kbp
1042	Ease On Down The Road	122	03:19.89	Michael Jackson	[2004] - The Ultimate C	Disco Funk Pop	Disco 2	192.0kbp
2366	It's Alright, I Feel It (lead vocals by Jocelyn Brown)	122	03:22.45	Masters At Work / Nuyorican Soul	Masters At Work / Nuyorican Soul	Breaks House Disco Acid Jazz Piano Classic	Add New 7f	246.0kbp

Figure 1. This is a screenshot of Barry's Serato library. Note the fairly consistent application of metadata throughout, particularly BPM. The inability of Serato to accommodate multiple types of genre can also be noted when Barry has had to list multiple genres in a single metadata field. The grouping category is used to denote situations in which a group of songs might be played; while most DJs I interviewed preferred to construct playlists based on this type of situation, Barry opted to keep context on the level of metadata, which he could use to narrow down his collection through sorting his collection by grouping.

Although Barry is constantly coming across new music – he spends hours every week poring over blogs and on music sites, as well as making regular visits to record stores – the list contains only those songs that he's entirely sure he will want to play. The list does not contain songs intended for a particular gig, but rather to an overall assurance that the list contains only songs he's vetted as playable: "I'm really picky about what goes in here ... It's not like 'oh, that's kind of cool, maybe I'll play that.' It doesn't go in here, ever." Essentially, Barry pushes the problem of organization from crates to metadata, which requires him to be judicious in terms of what goes into the list for playing, as well as rigid in applying metadata that he leverages in searching the list while performing. This is perhaps one means of addressing the issue that Shirky (2005) pointed out in the problematic nature of large, heterogeneous collections – by crafting a library within a library, Barry uses his subject-specific expertise to mitigate the disadvantages of an otherwise unwieldy collection.

In particular, Barry's system relies on BPM⁴ and genre. Metadata work begins with moving tracks into the iTunes playlist:

When I drag it into this one main [list] in iTunes, immediately, I'll BPM it and do all the genres that I can think for it ... Instead of having crates, instead of having differentiated playlists, everything is in genres. So if I have a reggae box that everything was in, I'm just fast on my fingers and type it, and so everything that would be appropriate is up when I type it ... That's pretty much it. It's simple and people don't get it and people don't do it. And it works.

With metadata in place, Barry can save himself the frantic hunting through a series of playlists as well as through a series of tracks – he instead types out a search term (such as a genre) that he wants to use to limit his bin in a particular moment, and make decisions about what to play accordingly. This points back to the user side of Shirky's (2005) ontology division – Barry is deeply knowledgeable about his own collection, and his consistent, dedicated metadata practices make him both authoritative on the music he collects and stable in the application of descriptors.

Barry is right to point out that his system is simple, in that it only requires the application of metadata. At the same time, his structurally-simple process requires a great deal of work: "I'll go through my routine, go through all these steps, BPM, detail genres, labor over which songs I put in at the expense of taking a shower before a gig. I'm just so dedicated to it." Based on interviews in this study, he's also right in his assessment that other DJs don't undertake this kind of work. Digital collections are so large that the task of metadata entry simply overwhelms most DJs. Beyond the sheer size of a collection, other problems surface from limitations of the platforms used to organize and play music in DJ work. Although Barry has a lot of confidence in his system, he nonetheless laments Serato's current search and organization functionality:

There's another level to take this to, and the technology's just not there ... I mean, this, I live by this thing, so it's not inconsequential. This is how I DJ, with this box [pointing at laptop], but I need to take it to another level. I need the tagging to be more flexible, more fluid in my interface. And I need better ways to search.

These references to flexible tagging and search functionality can be leveled at both Serato and iTunes. Neither application allows for mass updates of metadata on the file level, nor are there sufficiently sophisticated searching or tagging options. Without these functions, participants develop hacks and workarounds, as evidenced by the practices of Barry and, perhaps particularly, Jarod.

Embracing the brave new digital world

Jarod is also based in New York City, typically DJing two or three shows throughout the week and hosting a weekly radio show. He has a narrower range in what he plays, often hip hop, soul and funk, but also collects across a wide range of genres. Jarod's cataloging process is complex, beginning prior to either iTunes or Serato, with editing metadata tags of MP3s that he wants to bring into his music library. Before adding new MP3s to his main library, he brings the files into a "workspace" library, where he has set up preferences that facilitate the process of organization and cataloging:

I add the files to the [workspace] library, which causes iTunes to store a copy of each song's metadata in its database. Then I open a separate metadata editing program called Media Rage, which I'll use to strip the metadata out of the songs completely. This program only works on [entire] folders, which is why I need the separate iTunes library, which won't move all of my files to their separate alphabetical locations as soon as I add them to the library. Then I use iTunes to create a different, better functioning version of the tag including the information that was just stored in its database.

As Jarod walked me through his process, I was struck by the fact that he'd set up multiple accounts on his computer for the sole purpose of enabling him to have different sets of preferences for various applications that he uses to organize metadata. Organizing music thus shapes his technological practices at a very elementary level – even when he's not using his laptop for DJ purposes.

Where Barry relies on a single list that contains harshly-vetted materials and focuses his cataloging efforts on those, Jarod is rigorous in applying the same cataloging rules to files regardless of whether or not he intends to play them. Jarod is thorough in making sure that each asset has as

⁴ For both vinyl and Serato DJs, BPM acts as a point of convergence in linking otherwise disparate tracks. As Fin explained, combining songs based on BPM is a process in which "you're mixing songs together, and songs match based on their tempo. Also, to a lesser degree, electronic music can be combined based on its tempo." In other words, BPM allows DJs to play songs in sequence that are at the same tempo, and also makes it possible to layer track segments on top of each other to create new music.

complete a record as possible, utilizing all available itunes metadata fields, in some cases separating fields with delimiters in order to simulate additional fields:

I start off [the genre field] with the decade the song was released. Then, if there's another decade that the song references, I'll put that afterwards. So if a new song was produced to sound like it came out in the 80's, when I search for 80's pop, the song will come up. It's contextual enough that it should be there even though it's not technically from that era. Then I put all the applicable genres in order of prominence. ... I have to have the correct years for everything. Sometimes, I hate it. Say there is a compilation that came out in 2005 ... I will reluctantly select all and delete 2005. Then I will be like, "ugh" and have to go look up the year for every song.

In addition to his insistence on complete and accurate cataloging records, Jarod maintains playlists full of dummy files as a wish list of tracks and records he'd like to obtain, "so if I'm searching for something, I can pull up what I have and what I want all at the same time." For most DJs I interviewed, organizing music they already have is too much of a cataloging burden; Jarod's process includes cataloging he'd like to have, but doesn't actually own yet, such that for Jarod, metadata in itunes functions not only as a repository for the music that he has, but also documenting the process of acquisition.

Another practice that separates Jarod from other DJs I interviewed is his use of Apple Scripts to create smart playlists that populate based on metadata rules. Jarod first encountered Apple Scripts through consulting forums for Searto, and then realized that he could leverage scripts to create playlists that consist of tracks with metadata that don't conform to his standards. In cataloging terms, Jarod is maintaining authority control and metadata standards by curating tracks that show up on playlists crafted through Apple Scripts. These efforts speak to the kind of expertise, stability and authoritativeness referenced by Shirky (2005) as lending themselves to ontological efforts, however, it's worth noting that Jarod's cataloging techniques are entirely self-enacted, shaped by improvisation and experimentation rather than institutional or professional standards.

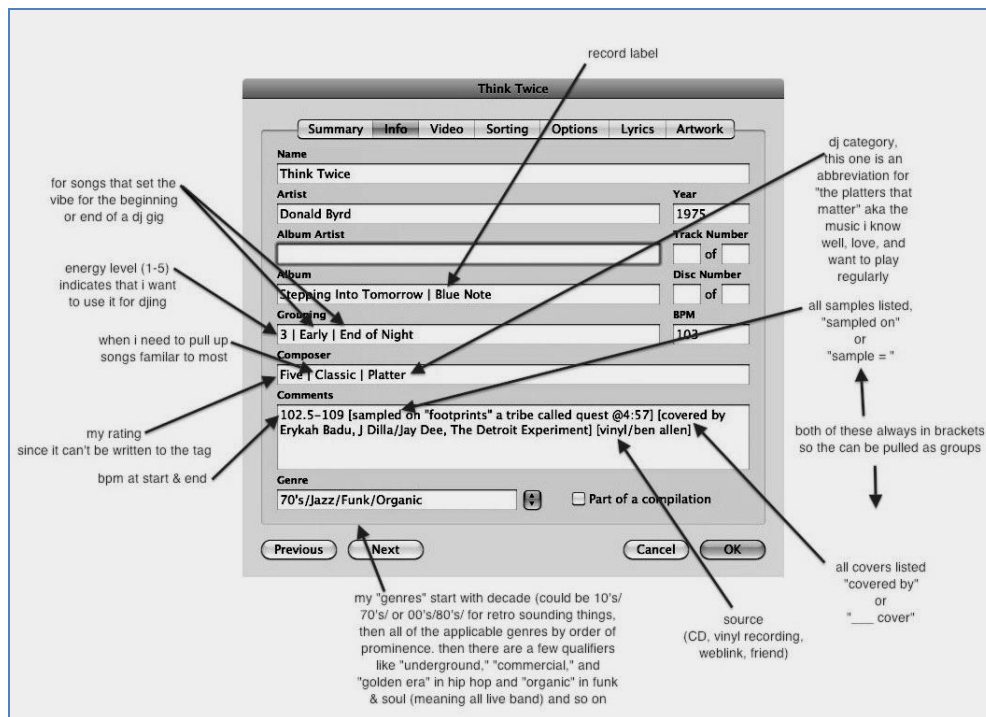


Figure 2. This image depicts Jarod's metadata fields in itunes. Note that the lack of available metadata fields has lead him to concatenate multiple descriptors in one field, separated with delimiters.

Although Jarod's DIY efforts have lead to an impressive set of organizational practices, he nonetheless feels limited by the current functionality of Serato and itunes. Similar to Barry, Jarod voiced frustrations with the limitations of the technological platforms for organizing digital music. In particular, he cites the lack of flexibility and extensibility offered by itunes and Serato: "It's all so bootleg, though,

everything I do. There's not enough fields, so the comment field has at least seven different types of data in it and I have like a post-it on my computer that says 'comment field tag order' so I always do it the right way." Nevertheless, where some DJs expressed a sense of dismay for the work of digital organization in contrast to physical assets, Jarod was notable in expressing a preference and even excitement for the opportunities of organization afforded by a digital system:

There was a point in time (a *long* time ago, pre-itunes) that I realized that my head couldn't hold the details anymore. So I started marking CDs and records with markers but the limitation was always that the physical object could only exist in one location ... Also, the markings were permanent and didn't leave room for changing my mind over time. So, when the digital DJing possibility came along, I was crazy excited about the possibilities of having my individual songs show up dynamically and being able to revise as I went. Basically when you are working with something you can only recall a small fraction of off the top of your head, your organization becomes an extension of your brain.

Most participants expressed a sense of excitement about digital media in terms of being able to gather ever larger and more diverse collections, but felt overwhelmed by tasks of organizing music. DJs are used to thinking of the music that they play as an extension of themselves (Brewster & Broughton, 2000), but it's the ability to view organization as creative, authoritative and a necessary use of time that's singular here. It also speaks to a series of gaps in conceptualizing DJ work: between playing and organizing music, between what applications offer and what DJs need, and between wanting access to a wide variety of music in one's personal collection and struggling to come up with systems that enable music to be located and used.

Discussion

DJs form a community of practice most obviously in terms of live performance work. As Gordon described,

When you know DJs well enough, you don't need to know who's playing the records, you can just tell who's the DJ, just by how they play the record ... These kind of imprints are the human quality of a DJ narrative, that comes with having the tools to be able to control things, and to control them in a way that affords you the ability to seamlessly put these things together. And the organization of the work is a reflection of that imagination.

Gordon's poignant description indicates the depth and intricacy of practices embedded in DJ work. It furthermore links quite neatly to Jarrod's statement earlier that "organization becomes an extension of your brain." This motif of organizational practices as an extension of creativity is useful in understanding the technological stakes of DJs maintaining their libraries. I want to make two points related to issues of organization and personal media collections – first, that DJs stand to gain from thinking of themselves as a community of practice bound by librarianship, and second that systems design serving this group stands to gain from thinking of DJs as librarians.

Implications for theory: Hang the DJ, I'm a librarian

Interestingly, a number of participants used the term librarianship to refer to DJ work, or more narrowly, to refer to a specific area of DJ work. In Em's terms: "one third of DJing is the actual being out in public, one third is knowing your technology – Serato, turntables, cables, amplifiers, speakers, all that shit – and then one third is librarianship." For DJs in this interview pool, at least, librarianship was tied to curation of music used in DJ work. Although this work is inherently technological, both Em and Ron seemed to divest librarian work in the context of DJing from technical components:

I know a lot of DJs that are basically librarians ... They're collectors, whatever, they're these super-knowledgeable people ... They don't have crazy skills, don't have a lot of knowledge about technical equipment, man, they know records, and that's a huge part of it.

Here, Ron essentially sets up a technological divide between skills for DJing and skills of organization, somewhat downplaying the latter. This is interesting particularly given the frustration expressed by so many participants about the limitations of systems like itunes and Serato in terms of organizing music. This is in keeping with Shirky's (2005) point that digital collections tend to be large, unwieldy and unstable, but Shirky's solutions of opening their collections up to folksonomies or collective tagging are untenable for most DJs. Instead of thinking of themselves as librarians because of their deep knowledge

of music, DJs could start to think of themselves as librarians because they leverage knowledge of music into systems of organization that act as extensions of their creativity, which includes organizing as much as performing music. As this paper has documented, some DJs are already crafting their own organizational solutions, but far more could benefit from collective knowledge sharing about these practices. They furthermore need the technological support from applications used on a daily basis in DJ work.

Implications for design: I've got the skills, now give me the tools

Put simply, music applications intended to facilitate DJ work fail because they anticipate their systems being used by DJs rather than librarians; there seem to be design assumptions that iTunes and Serato are for playing first and organizing second, if at all. This fails to reflect some of the DJ workflows I encountered, but it also ignores the sheer vastness of DJ collections and the contingent problems of organization. DJs recognize the potential affordances of librarianship for their media collections but lack the tools to fulfill that part of DJ work. In this paper, I focused on the practices of two highly motivated DJs as indicative of the lengths to which some DJs go to build sophisticated systems of organization. My argument is not that designers should cater to users like Barry and Jarod, but to point out that more DJs would have collections as organized and structurally sophisticated as theirs if sufficient tools of cataloging and metadata were available. Applications like iTunes and Serato could start by providing extensible metadata fields and more sophisticated searching options. They should enable hierarchical crates and facilitate the process of building playlist rules. These functions reflect the needs of DJs as librarians tasked with managing large collections of digital media.

Organizational functionality could also expand beyond these applications to include other sites of DJ work. Volda et al. (2005) argued that "one of the greatest challenges for technical innovation in music sharing may be in allowing designers to make the leap between treating music sharing technologies as personal music listening utilities and treating music sharing technologies as online communities" (p. 200). The prevalent use of online music sharing platforms like Juno and Soundcloud shows the extent to which these boundaries are already quite fluid, but as is the case for most HCI research on DJ work, practices of organization are basically ignored. Sites like Juno and Soundcloud could provide platforms for explicit discussion of organization, ranging from discussions of genre to sharing organizational practices. Although willingness to share music varied across DJs I interviewed (typically out of a protectiveness of rare music), participants were far more willing to share how they organize their music. As Barry responded when I asked about talking to other DJs about his organizational process, "Sure, because it helps, it helps me be a better artist ... if there's a way for people to be better artists, it elevates the whole field."

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